13 Pipe and Structure Backfill

CHAPTER THIRTEEN: PIPE AND STRUCTURE BACKFILL

BACKFILL LIMITS

The trench for the pipe is required to be backfilled as shown on the plans or Standard Sheets with B borrow (Section **211.02**) or flowable mortar (Section **213.02**). When flowable mortar is used, the Contractor is required to submit a mix design and arrange for a trial batch demonstration.

BASIS OF USE

The basis of use for B borrow is a Certified Aggregate Producer Program (CAPP) D Number. The Frequency Manual should be reviewed to verify what the testing requirements are. The basis of use for flowable mortar is the flow test.

To perform the flow test, a 3 inch diameter by a 6 inch cylinder is placed on a smooth level surface and filled to the top with the flowable mortar. The cylinder is quickly pulled straight up and the mortar spread measured. The diameter of the mortar spread is required to be at least 8 inches and is to be recorded on the IT-652. There is also a 14-day strength requirement for flowable mortar. The average penetration resistance is required to be at least 1200 psi and not more than 5000 psi. **ASTM C 403** and **ITM 213** are used to conduct these tests (See Appendix).

BACKFILL METHODS

There are different methods of backfill required, depending on where the pipe structure is located and what the purpose of the structure is. These are shown on Standard Drawings **E 715-BKFL -01** through **E 715-BKFL -08**.

TRENCH DETAILS

The basic trench details are shown on Standard Drawings **E 715-BKFL-01** through **E 715-BKFL-08**.

ROCK

If rock is encountered during excavation for the pipe, the rock is required to be removed 6 inches below the bottom of the pipe. B borrow is used as backfill to bring the pipe to the proper flowline.

BEDDING DETAILS

All of the details use B borrow for structure backfill or flowable mortar bedding for pipe (where pipe is bedded in a soil cradle cut). On Standard Drawings **E 715-BKFL-01, -03, -05**, and **-07** the proper limits and dimensions for backfilling with B borrow are shown. On Standard Drawings **E 715-BKFL-02, -04, -06** and **-08** the proper limits and dimensions for backfilling with flowable mortar are shown.

BACKFILL PLACEMENT

All plastic pipes that are not fabricated with hydrostatic design basis resigns, except underdrains, are to be backfilled with flowable mortar when the pipes are within 5 feet of the mainline or public road approaches.

Placement of B borrow as backfill material is required to be in 6 inch loose lifts and compacted with mechanical compactors to the required density. When compacting B borrow, the material is required to be at optimum moisture content to obtain the required density.

Flowable mortar is required to be uniformly placed up to the fill line as shown on the plans or Standards. Before flowable mortar is placed in a trench, all standing water is required to be removed. If removal of water is not possible, B borrow is used up to an elevation of 2 feet above the ground water.

METHOD 1 BACKFILL

When a pipe is placed under the mainline pavement or is within 5 feet or less of the pavement, sidewalk, curbs or gutters, Method 1 Backfill is to be used. Pipes placed under public road approaches also use Method 1 Backfill. Method 1 requires that flowable mortar or B borrow be used as backfill for the width of the pavement plus 5 feet on each side of the pavement. Method 1 is also used for a distance that is required to maintain a 2:1 slope from the above width down to the bottom of the pipe structure. Method 1 Backfill for a fill section is shown on Standard Drawings **E 715-BKFL-01** and **715-BKFL-02**. and for a cut section is shown in Standard Drawings **E 715-BKFL-03** and **E 715-BKFL-04**. The proper elevation of backfill material should always be maintained as shown in the above Standards. The remaining area may be backfilled with suitable materials in layers of not more than 6 inches when inside the slope stake area.

METHOD 2 BACKFILL

When a pipe is placed under commercial or private drive approaches, Method 2 Backfill is used. Method 2 requires that B borrow or flowable mortar be placed at a height of over one-half the outside diameter of the pipe structure. The length of the backfill material is the same as Method 1 Backfill. Method 2 Backfill for a cut and a fill section is shown on Standard Sheets **715-BKFL-07** and **715-BKFL-08**. The remaining area may be backfilled with suitable materials in layers of not more than 6 inches when inside the slope stake area.

OTHER BACKFILL

Where other than special backfill material is required, the material is required to be easily compacted and free of large stones for the portions around and 6 inches above the pipe.

BACKFILLING OUTSIDE SPECIFIED LIMITS

If the structure is outside the aforementioned areas, the pipe may be backfilled with suitable material.

COVER LIMITS

The proper cover is required to always be maintained for heavy equipment to cross pipe structures during construction. The cover requirements are:

1) Up to and including 18 in. diameter or equal - 1 ft 6 in. cover
2) 21 in. up to and including 54 in. diameter or equal - 3 ft 0 in. cover
3) Over 54 in. diameter or equal - 4 ft 0 in. cover

RAMPS OVER STRUCTURE FOR PROTECTION

If the minimum amount of cover is not available, the Contractor is required to ramp over with soil to provide the cover needed to prevent structure damage.

LIMITATIONS

Flowable mortar is not to be placed on frozen ground and is required to be protected from freezing until set. Flowable mortar may not be loaded or

disturbed by construction until an average penetration resistance of 70 psi under a Portland Cement pavement or 1200 psi under a HMA pavement is obtained.

PAYMENT FOR STRUCTURE BACKFILL

B BORROW

When the proposal contains an item for B borrow for structure backfill, the material is paid for by the cubic yard based on a theoretical measurement. The Construction Record Guide has charts showing different cover heights and the amount of B borrow per linear foot required for different pipe diameters and material types. This guide is for pipe backfill limits only. The cost of backfilling manholes, inlets and catch basins is included in the item cost. (B borrow Backfill Tables in Appendix B)

FLOWABLE MORTAR

When the contract contains an item for flowable mortar, this material is paid for by the cubic yard based on a neat line theoretical measurement. If flowable mortar is used as a substitute for B borrow for structure backfill or if used to backfill plastic pipe fabricated with nonhydrostatic design basis resins, flowable mortar is paid as B borrow for structure backfill.

EXAMPLE PROBLEM

A Contractor placed a 30 inch diameter corrugated metal pipe which measured 152 Lft. outside to outside of the inlets. The technician measured the cover in several locations and found the coverage to be an average of 5.8 feet. The theoretical pay quantity for B borrow for structural backfill would be:

Using the Appendix, Table 5, factor = 1.2203 yd^3/Lft.

152 Lft. x 1.2203 yd^3/Lft. = 185.5 yd^3